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(54) **POLYOLEFIN COMPOSITION CONTAINING LOW VISCOSITY PROPYLENE HOMOPOLYMER,
FIBER AND EXTENSIBLE NON-WOVEN FABRIC PREPARED THEREFROM**

POLYOLEFIN ZUSAMMENSETZUNG, FASERN UND AUSGEBREITETE FILZE AUF DER BASIS
VON PROPENE HOMOPOLYMER MIT GERINGER VISKOSITÄT

COMPOSITION POLYOLEFINIQUE CONTENANT UN HOMOPOLYMER DE PROPYLENE A
FAIBLE VISCOSITE, FIBRE ET NON-TISSE EXTENSIBLE FABRIQUES A PARTIR DE CETTE
COMPOSITION

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WO-A-99/14261 US-A- 5 529 845
US-A- 5 549 867**

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Description**Background of the Invention**

5 **[0001]** The present invention relates to a polyolefin composition containing a crystalline propylene homopolymer having a high melt flow rate, and an olefin polymer composition, as well as fiber and non-woven fabric prepared therefrom. Non-woven fabrics prepared from fibers of this polyolefin composition exhibit a desirable combination of acceptable tensile strength, superior cross-directional fabric elongation, good processability, and improved fabric softness and drape.

10 **[0002]** International Patent Application WO 99/14261 discloses compositions comprising a blend of a linear low density polyethylene and a low viscosity propylene polymer having utility in the production of stretch wrap films.

[0003] European Patent Application No. 1059332 discloses bimodal polypropylene blends having high dispersion index and showing a good balance between melt strength and drawability in the preparation of films and fibers.

[0004] U.S. Patent No. 5,529,845 discloses fibers and non-woven fabrics made from compositions having a high content of polypropylene of low melt flow rate which require a relatively high processing temperature.

15 **[0005]** U.S. Patent No. 5,549,867 discloses an enhanced productivity melt spinning process wherein polyolefin resin blends are employed including a relatively small portion of a component having high melt flow rate and narrow molecular weight distribution and a larger portion of a component having low melt flow rate and narrow molecular weight distribution. The content of comonomers in the components is not specified.

20 **[0006]** U.S. Patent No. 5,460,884 discloses a non-woven fabric prepared from a polyolefin composition having a highly crystalline propylene homopolymer as a major component and a heterophasic ethylene/propylene random copolymer as a minor component. The non-woven fabric is said to be very strong but yet soft in comparison to comparable non-woven fabrics.

25 **[0007]** Non-woven fabrics have gained acceptance in various products, including diapers, disposable medical products and personal hygiene products. Non-woven fabrics destined for use in these applications may be subjected to post-manufacturing finishing operations such as coating or stretching. Fabrics having high tensile strength can be difficult to process, and also may exhibit inadequate suppleness ("drape") as well as reduced fabric elongation.

[0008] Non-woven fabrics prepared from polyolefin fibers having a high melt flow rate have been proposed. Thus, U.S. Patent No. 5,529,850 discloses fibers and non-woven fabrics produced from crystalline propylene polymers and copolymers having a polydispersity index of 2.5 to 3.7 and a melt flow rate of from 600 to 2000 g/10 minutes.

30 **[0009]** An object of this invention is to provide a polyolefin composition capable of being formed into fibers of fine diameter.

[0010] Another object of this invention is to provide a polyolefin fiber capable of being formed into a non-woven fabric having a combination of desirable properties, including acceptable tensile strength, superior cross-directional fabric elongation, good processability, and improved fabric softness and drape.

35 **[0011]** A feature of this invention is a polyolefin composition which includes an as-polymerized, high melt flow rate (MFR) propylene homopolymer and a random copolymer of propylene and ethylene and/or a C₄₋₁₀ alpha-olefin.

[0012] Another feature of this invention is a fiber prepared from this polyolefin composition and which has a diameter of from 15 to 23 microns.

40 **[0013]** Yet another feature of this invention is a nonwoven fabric prepared from this polyolefin fiber and which has superior cross-directional fabric elongation, as measured by peak tensile elongation.

[0014] An advantage of the nonwoven fabric of the present invention is that it has improved processability, softness and drape.

SUMMARY OF THE INVENTION:

45 **[0015]** The present invention relates to a polyolefin composition comprising:

A. 45 to 5 weight percent of a low viscosity propylene homopolymer having an as polymerized MFR of from 250 to 550 g/10 minutes, as measured by ASTM D-1238, Condition L (230°C/2.16Kg); and

50 B. 55 to 95 weight percent of an olefin polymer composition selected from the group consisting of

(1) a random copolymer of propylene and ethylene and/or a C₄₋₁₀ alpha-olefin, with the copolymer containing from 90 to 99 weight percent propylene;

55 **[0016]** The present invention also relates to fibers prepared from this polyolefin composition, with the fibers having a diameter of from 15 to 23 microns.

[0017] In another embodiment, the present invention is a nonwoven fabric prepared from fibers made from the polyolefin composition.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS:

[0018] The polyolefin composition of the present invention contains from 5 to 45, preferably 5 to 40, and most preferably 10 to 40, weight percent of a low viscosity propylene homopolymer. The propylene homopolymer may be prepared by polymerization of propylene using known Ziegler-Natta catalyst systems and according to known methods operating in liquid phase comprising the propylene monomer or a solution thereof, in an aliphatic or aromatic hydrocarbon solvent, or in gas phase, or combining liquid and gas polymerization steps.

[0019] The polyolefin composition of the present invention also contains from 55 to 95, preferably 60 to 95 weight percent, and most preferably from 60 to 90 weight percent of an olefin polymer composition B, which is a random copolymer of propylene and ethylene and/or a C₄₋₁₀ alpha-olefin. The random copolymer contains from 90 to 99, preferably from 95 to 98, most preferably from 96.5 to 99, weight percent propylene, with the balance being ethylene, a C₄₋₁₀ alpha-olefin, a mixture of both ethylene and a C₄₋₁₀ alpha-olefin or a mixture of C₄₋₁₀ alpha-olefins. Examples of random copolymers that can be used as olefin polymer composition B include propylene/ethylene propylene/1-butene, propylene/1-pentene, propylene/1-octene and propylene/ethylene/1-butene copolymers.

[0020] The random copolymer may be prepared from the respective monomers by conventional copolymerization using conventional apparatus and techniques well known to those of ordinary skill in the art. Random copolymers of propylene and ethylene with or without 1-butene are commercially available from companies such as Basell USA, Inc.

[0021] The random copolymer a MFR of at least 10, preferably 10 to 40, g/10 minutes, as measured according to ASTM D-1238, Condition L (230°C/2.16Kg.). These melt flow rate values may be obtained directly in polymerization, or by visbreaking.

[0022] The catalysts that can be used to produce the polymer composition of the present invention are well known in patent literature. Particularly suited are the catalysts described in U.S. Patent Nos. 4,339,054, 5,539,067 and 5,618,771. Other examples of catalysts are described in U.S. Patent Nos. 4,472,524 and 4,473,660.

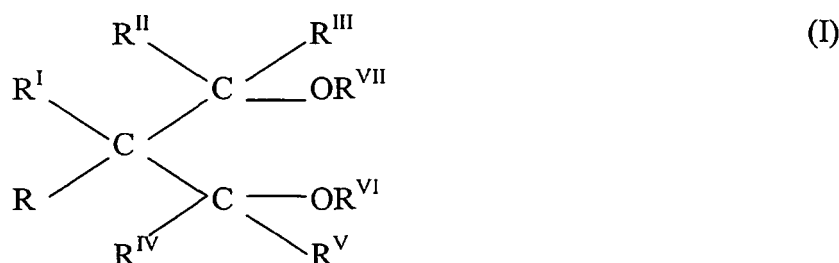
[0023] The above mentioned catalysts used in the polymerization comprise the product of the reaction between:

- a) a solid component, containing a titanium compound and an electron-donor compound (internal electron donor) supported on magnesium chloride in active form,
- b) an aluminum alkyl compound (cocatalyst) and
- c) an electron-donor compound (external electron-donor).

[0024] These catalysts are preferably capable of producing propylene homopolymer having an isotactic index higher than 90%.

[0025] The solid catalyst component (a) contains as electron-donor a compound selected among the ethers, ketones, lactones, compounds containing N, P and/or S atoms, and mono- and dicarboxylic acid esters.

[0026] Suitable electron-donors for solid catalyst component (a) include monobenzyl monobutyl phthalate; malonic acid esters such as diisobutyl and diethyl malonate; alkyl and arylpivalates; alkyl, cycloalkyl and aryl maleates; alkyl and aryl carbonates such as diisobutyl carbonate, monoethyl monophenyl carbonate, and diphenyl carbonate; succinic acid esters such as mono- and diethyl succinate. Particularly suitable are phthalic acid esters such as diisopropyl, di-n-butyl, diisobutyl, di-n-pentyl, diisopentyl, dihexyl, diheptyl and dioctyl phthalate. Other electron-donors particularly suited are the 1,3-diethers of formula (I):



wherein R, R^I, R^{II}, R^{III}, R^{IV} and R^V are the same or different and are H, C₁₋₁₈ linear or branched alkyl, C₅₋₁₈ cycloalkyl, C₆₋₁₈ aryl, C₇₋₁₈ alkylaryl or C₇₋₁₈ arylakyl radicals, provided that when R is H or alkyl, R^I is other than H or alkyl and when R^I is H or alkyl, R is other than H or alkyl; R^{VI} and R^{VII} are the same or different and are C₁₋₁₈ linear or branched alkyl, C₅₋₁₈ cycloalkyl, C₆₋₁₈ aryl, or C₇₋₁₈ arylakyl radicals; and two or more of R R^V may be bonded to form a cyclic structure having 5 to 18 carbon atoms. Illustrative examples of ethers whose structures conform to formula (I) include 2,2-diphenyl-1,3-dimethoxypropane, 2,2-dibenzyl-1,3-dimethoxypropane, 2,2-bis(cyclohexylmethyl) 1,3-dimethoxypro-

pane, 1,3-bis(methoxymethyl)cyclohexane and 2,2'-bis(methoxymethyl)norbornane, 2-methyl-2-isopropyl-1,3-dimethoxypropane, 2,2-diisobutyl-1,3-dimethoxypropane, and 2-isopropyl-2-cyclopentyl-1,3-dimethoxypropane. The diethers of the type described are disclosed in U.S. Patent No. 5,095,153, the disclosures of which are incorporated herein by reference

[0027] The preparation of the described catalyst components is done according to various methods. One of them consists of milling or co-milling the magnesium dihalide (used in the anhydrous state containing less than 1% water), together with the titanium compound, and the electron-donor compound under conditions where the magnesium dihalide is activated; the milled product is then treated one or more times with excess TiCl_4 at temperatures from 80 to 135° C, and subsequently washed repeatedly with a hydrocarbon (hexane, for example) until the chlorine ions have disappeared from the wash waters. The electron-donor compound may also be added during the milling operation or during the treatment with excess TiCl_4 . If more than one treatment with excess TiCl_4 is employed, the electron donor compound is added during the first treatment.

[0028] According to another method the anhydrous magnesium halide is preactivated according to known methods, and then treated one or more times with excess TiCl_4 containing the electron-donor compound in solution. In this case the operation also takes place at a temperature from 80 to 135° C. Optionally, the TiCl_4 treatment is repeated. The solid is then washed with hexane or other solvents to eliminate all traces of unreacted TiCl_4 . The electron-donor compound may also be added during the treatment with excess TiCl_4 , preferably during the first treatment, if more than one treatment with excess TiCl_4 is used.

[0029] According to another method, a MgCl_2nROH adduct (particularly in the form of spherical particles) where n is generally a number ranging from 1 to 3 and ROH is ethanol, butanol or isobutanol, is treated one or more times with excess TiCl_4 containing the electron-donor compound in solution. The electron-donor compound may also be added during the treatment with excess TiCl_4 , preferably during the first treatment, if more than one treatment with excess TiCl_4 is used. The reaction temperature generally ranges from 80 to 120 °C. After the reaction the solid is isolated and treated one or more times with TiCl_4 , and then washed with a hydrocarbon solvent until all traces of unreacted TiCl_4 have been eliminated.

[0030] According to yet another method, magnesium alcoholates and chloroalcoholates (the chloroalcoholates can be prepared according to U.S. Patent No. 4,220,554) are treated one or more times with excess TiCl_4 containing the electron-donor compound in solution, operating under the same conditions already described. The electron-donor compound may also be added during the treatment with excess TiCl_4 , preferably during the first treatment, if more than one treatment with excess TiCl_4 is used.

[0031] The titanium compound in the solid catalyst component, expressed as Ti content, is generally present in the amount ranging from 0.5 to 10% by weight, and the quantity of the electron-donor compound that remains set on the solid magnesium dihalide usually ranges from 5 to 20% in moles with respect to the magnesium dihalide.

[0032] Titanium compounds which can be used for the preparation of catalyst components are halides or halogen alcoholates. Titanium tetrachloride is the preferred compound. Satisfactory results are obtained also with titanium trihalides, particularly TiCl_3HR (HR=Hydrogen Reduced), TiCl_4ARA (ARA=Aluminum Reduced and Activated), and with titanium halide alcoholates such as TiCl_3OR , where R is a phenyl radical.

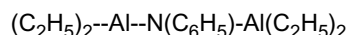
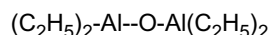
[0033] The preparations indicated above lead to the formation of activated magnesium dihalide. Besides the ones already mentioned, other reactions are known in the art which lead to the formation of activated magnesium dihalides starting from magnesium compounds which are different from the magnesium halides, such as magnesium carboxylates.

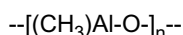
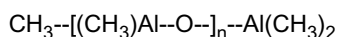
[0034] The active form of magnesium halides in the solid catalyst component can be recognized by the fact that in the X-ray spectrum of the catalyst component the major intensity reflection presents a width at half-peak at least greater than 30% with respect to the major intensity reflection which appears in the spectrum of the nonactivated magnesium dihalide, or by the fact that the major intensity reflection (which appears in the spectrum of the nonactivated magnesium halides, having a surface area smaller than 3 m²/g) is absent and in its place there is a halo with the maximum intensity shifted with respect to the position of the maximum intensity reflection of the nonactivated magnesium dihalide. The most active forms of magnesium halide are those where the X-ray spectrum shows a halo.

[0035] Among the magnesium dihalides, the magnesium chloride is the preferred compound. In the case of the most active forms of magnesium chloride, the X-ray spectrum of the catalyst component shows a halo instead of the reflection, which in the spectrum of the nonactivated magnesium chloride is situated at the distance of 2.56 Å.

[0036] As cocatalysts (b), one preferably uses the trialkyl aluminum compounds, such as Al-triethyl, Al-triisobutyl and Al-tri-n-butyl.

Other examples of cocatalysts (b) are the linear or cyclic Al-alkyl compounds containing two or more Al atoms bonded by means of O, or N atoms, or by SO_2 , SO_3 or SO_4 groups. Some examples of these compounds are:





wherein n is a number from 1 to 20.

[0037] In general, the Al-Alkyl compound is present in quantities that allow the Al/Ti ratio to vary from 1 to 1000.

[0038] The electron-donor compounds (c) that can be used as external electron-donors comprise the aromatic acid esters (such as alkyl benzoates), heterocyclic compounds (such as the 2,2,6,6-tetramethylpiperidine and 2,6-diisopropylpiperidine), and in particular silicon compounds containing at least one Si-OR bond (where R is a hydrocarbon radical). Some examples of silicon compounds are: (tert-C₄H₉)₂ Si(OCH₃)₂ and (C₆H₅)₂Si(OCH₃)₂. Suitable silicon compounds are described in U.S. Patent Nos. 5,539,067 and 5,618,771 and U.S. Serial No. 08/469,735, the disclosures of which are incorporated herein by reference.

[0039] The 1,3-diethers of formula (I) are also suitable to be used as external donors. In the case that the internal donor is one of the 1,3-diethers of formula (I), the external donor can be omitted.

[0040] The catalysts can be precontacted with small quantities of olefins (prepolymerization), maintaining the catalyst in suspension in a hydrocarbon solvent, and polymerizing at temperatures ranging from ambient to 60°C. The quantity of polymer produced is from 0.5 to 3 times the weight of the catalyst.

[0041] The prepolymerization can also be carried out in liquid propylene under the temperature conditions indicated above, and can produce quantities of polymer that can reach up to 1000 g per gram of catalyst component.

[0042] The propylene homopolymer has a MFR of from 250 to 550, preferably 350 to 450, and most preferably 380 to 420 g/10 minutes, as measured by ASTM D-1238, Condition L (230°C/2.16Kg). These MFR values are obtained directly in polymerization ("as polymerized"), and not by post-polymerization (visbreaking) techniques well known to those of ordinary skill in this art.

[0043] Propylene homopolymers suitable for use in the present invention are commercially available from Basell USA Inc.

[0044] The polyolefin composition of the present invention may be prepared by mixing together the olefin polymer composition and propylene homopolymer using conventional techniques and apparatus well known to those of ordinary skill in the art. For example, the two components may be mixed together in a mixer, and extruded into pellets using a single screw conventional extruder operated at conventional temperatures and mixing speeds.

[0045] The polyolefin composition has a MFR of 20 to 70 g/10 minutes, preferably 25 to 65 g/10 minutes, as measured according to ASTM D-1238, Condition L (230°C/2.16Kg)

[0046] The molecular weight distribution of a polymer (MWD) is defined as the weight average molecular weight (M_w) divided by the number average molecular weight (M_n).

[0047] The polyolefin composition of the present invention typically has a polydispersity index of from 3.0 to 4.5, preferably from 3.3 to 3.7, and most preferably from 3.5 to 3.7. Polydispersity Index (P.I.) is a parameter obtained by way of rheologic measurement, and which is correlated to the polymer's molecular weight distribution. In particular, the lower the P.I., the narrower the MWD.

[0048] The polyolefin composition preferably includes one or more organic phosphites and/or phosphonites, one or more HALS (Hindered Amine Light Stabilizer) and one or more phenolic antioxidants. Specific examples of phosphites include tris(2,4-di-tert-butylphenyl)phosphite marketed by Ciba Specialty Chemicals Corp. under the trademark Irgafos 168; distearyl pentaerythritol diphosphite marketed by GE Specialty Chemicals under the trademark Weston 618; 4,4'-butylidenebis(3-methyl-6-tert-butylphenyl-ditridecyl)phosphite marketed by Ashasi Denka under the trademark ADK Stab P; tris (monononylphenyl)phosphite; bis(2,4-di-tert-butyl) pentaerythritol diphosphite, marketed by GE Specialty Chemicals under the trademark Ultrinox 626.

[0049] HALS are monomeric or oligomeric compounds containing in the molecule one or more substituted amine, preferably piperidine, groups. Specific examples of HALS containing substituted piperidine groups are the compounds sold by Ciba Specialty Chemicals Corp. under the following trademarks: Chimassorb 944; Tinuvin 770, Tinuvin 765, Tinuvin 622, Tinuvin 144, and the product sold by Cytec Industries Inc. under the trademark Cyasorb UV 3346.

[0050] Illustrative examples of phenolic antioxidants include tris-(4-tert-butyl-3-hydroxy-2,6-dimethylbenzyl)-s-triazine-2,4,6-(1H,3H,5H)trione; calcium bi[monoethyl(3,5-di-tert-butyl-4-hydroxy-benzyl)phosphonate]; 1,3,5-tris(3,5-di-tert-butyl-4-hydroxybenzyl)-s-triazine-2,4,6-(1H,3H,5H)trione; 1,3,5-tri-methyl-2,4,6-tris(3,5-di-tert-butyl-4-hydroxybenzyl) benzene; pentaerythrityl-tetrakis[3-(3,5-di-tert-butyl-4-hydroxyphenyl) propionate]; octadecyl-3-(3,5-di-tert-butyl-4-hydroxyphenyl)pro- pionate; and 2,6-dimethyl-3-hydroxy-4-tert-butylbenzyl abietate.

[0051] A preferred stabilizer package comprises 200-400 ppm Irgafos 168 tris(2,4-di-tert-butylphenyl)phosphite; 200-400 ppm Tinuvin 622 poly(N-beta-hydroxymethyl-2,2,6,6-tetramethyl-4-hydroxy-piperidyl succinate) hindered

amine light stabilizer; and 200-400 ppm calcium stearate. These stabilizers can be added to the polyolefin composition by means of an extruder with subsequent pelletization or surface coating, or they can be mechanically mixed with the polyolefins.

[0052] Other additives conventionally used in the production of continuous polymer filaments can also be incorporated in the polyolefin polymer composition such as UV stabilizers, pigments, delusterants, lubricants, antistatic agents, water and alcohol repellents, etc. in conventional amounts, which are typically no more than about 10% by weight.

[0053] The polyolefin composition of the present invention may be manufactured into fibers and films using conventional techniques and apparatus well known to those of ordinary skill in the art. Thus, for example, the composition may be extruded through a spinnerette into a fiber or filament which is then oriented and quenched prior being wound onto a bobbin. Alternatively, the extruded fiber may be immediately formed into a non-woven fabric using known techniques such as spunbonding, meltblowing, needlepunching, air-layering etc. The term "nonwoven fabric" means a web having a structure of individual fibers or threads which are interlaid, but not in a regular, repetitive manner as in a knitted fabric. The fibers of the present invention have particular utility as starting materials for the production of nonwoven fabrics.

[0054] Fibers prepared from the composition of the present invention typically have a fiber diameter of from 15 to 23 microns, preferably 16 to 17.5 microns, and most preferably 16 to 17 microns.

[0055] The spunbond process generally uses a hopper which supplies polymer to a heated extruder, which supplies molten polymer to a spinnerette where the polymer is formed into a plurality of filaments by passing it through the holes of the spinnerette. The filaments are usually quenched with air at a low pressure, drawn, usually pneumatically, and deposited on a moving foraminous mat, belt or "forming wire" to form the nonwoven fabric. Spunbonding processing temperatures generally range from about 175°C to 320°C.

[0056] "Cross-directional peak elongation" is the fabric elongation when fabric strength is at its peak. "Cross directional elongation" is the maximum elongation at which the fabric fails. CD elongation is higher than CD peak elongation.

[0057] At a given fiber diameter, fabric elongation will generally be highest when the fabric is bonded at the optimum bonding temperature. Fabric elongation decreases with a decrease in fabric weight.

[0058] The nonwoven fabrics of the present invention have superior cross-directional fabric elongation, as measured by peak tensile elongation, and relatively low tensile strength. Thus, the nonwoven fabrics of the present invention preferably have a peak tensile elongation of at least 80%, still more preferably at least 100%, and most preferably a peak tensile elongation of at least 120%, as measured by ASTM D-5035, at a fabric weight of from 21 to 26 g/m². Such non-woven fabrics will exhibit a desirable combination of processability (e.g., high melt spinning speeds of at least 4000 meters/minute at a melt temperature of 220°C) and improved "drape" when manufactured into nonwoven articles or nonwoven components of articles such as diapers, disposable medical products, e.g., hospital gowns, and personal hygiene products, e.g., sanitary napkins.

[0059] In a preferred embodiment, the nonwoven fabric of the present invention has a relatively low tensile strength of less than 750 g/cm, as measured by ASTM D-5035. It is preferred that the nonwoven fabric's tensile strength be less than 700 g/cm, even more preferred if the tensile strength is less than 600 g/cm, and most preferred if the tensile strength is about 350 g/cm.

Examples

[0060] The following Examples are intended to illustrate specific embodiments of the present invention, and are not to be construed to limit the permissible scope of the invention in any manner whatsoever.

Example I

[0061] Polyolefin compositions were converted into spunbond fabric samples having a fabric weight of 25 g/m² using a Reifenhauser II spunbond machine. The homopolymers were extruded at 232°C (450°F) while the polyolefin compositions were extruded at 213°C (415°F). Fabric prepared from the homopolymers was bonded at 132°C (270°F) while fabric prepared from the polyolefin compositions was bonded at 121°C (250°F). Fabric testing was performed according to ATSM D-5035, Strip Tensile, using 2.54x15.24cm (1x6 inch) samples and a crosshead speed of 30.5cm/min (12 inches/minute). Five specimens were tested per sample to arrive at average fabric elongation and tensile strength.

TABLE 1

Sample	MFR g/10 min	P.I.	Fiber Diameter micron	CD Tensile Strength g/cm	CD Peak Tensile Elongation %
Comparative Example I-1 ⁽¹⁾	35	2.3	17.3	750	77%

(continued)

Sample	MFR g/10 min	P.I.	Fiber Diameter micron	CD Tensile Strength g/cm	CD Peak Tensile Elongation %
Comparative Example I-2 ⁽²⁾	35	3.6	17.9	688	98%
Comparative Example I-3 ⁽³⁾	65	3.7	17.5	623	80%
Comparative Example I-4 ⁽⁴⁾	35	2.1	17.8	596	54%
Comparative Example I-5 ⁽⁵⁾	38	3.4	22.4	615	80%
Comparative Example I-6 ⁽⁶⁾	53	3.3	21.5	604	77%
Example I-7 ⁽⁷⁾	53	3.6	16.9	583	157%
(1) Sample I-1 is a visbroken propylene homopolymer. (2) Sample I-2 is an as-polymerized propylene homopolymer. (3) Sample I-3 is a blend of 80 wt % propylene homopolymer as in Sample I-1 and 20 wt % as-polymerized propylene homopolymer having a MFR of 400 g/10 minutes commercially available from Basell USA Inc. (4) Sample I-4 is visbroken random propylene/ethylene copolymer. (5) Sample I-5 is an as-polymerized random copolymer. (6) Sample I-6 is an as-polymerized random copolymer. (7) Sample I-7 is a polyolefin composition of the present invention made of 80 wt % of a random copolymer as in sample I-5 and 20 wt % of an as-polymerized propylene homopolymer having a MFR of 400 g/10 minutes commercially available from Basell USA Inc.					

[0062] Several observations can be taken from Table I :

1. Sample I-4 (a visbroken random propylene/ethylene copolymer having a MFR of 35g/10 min) produced a nonwoven fabric having a lower peak elongation than nonwoven fabric produced from sample I-1 (a visbroken propylene homopolymer having a MFR of 35g/10 min).
2. Sample I-5 (a random copolymer having an as polymerized MFR of 38 g/10 min.) produces poorly formed nonwoven fabric having coarse hand and a peak elongation comparable to visbroken propylene homopolymer having a MFR of 35g/10 min (sample I-1).
3. Sample I-2 (a propylene homopolymer having an as polymerized MFR of 35 g/10 min.) produced a nonwoven fabric having a peak elongation superior to that of sample I-1 (propylene homopolymer visbroken to a MFR of 35 g/10 min.)
4. Sample I-7 (a polyolefin composition of the present invention) produced a non-woven fabric having a clearly superior peak elongation.

Example II

[0063] Polyolefin compositions were prepared and formed into non-woven fabrics using the general procedures of Example 1 but using different equipment. The fabric produced had a fabric weight of 22 g/m². Sample descriptions are set forth in Table 2, sample characteristics are set forth in Table 3, and sample elongation and tensile strengths are reported in Table 4.

TABLE 2

Sample Description		
Sample No.	Description	MFR
COMP. II-1	Propylene homopolymer	35
COMP. II-2	Random copolymer ⁽¹⁾	38

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(continued)

Sample Description		
Sample No.	Description	MFR
COMP. II-3	Random copolymer ⁽²⁾	52
EX. II-4	80% II-2 + 20% propylene homopolymer ⁽³⁾	60
EX. II-5	90% II-2 + 10% propylene homopolymer ⁽⁴⁾	44
EX. II-6	63% random copolymer + 37% propylene homopolymer ⁽⁵⁾	39
(1) Random copolymer of propylene and ethylene having 3 wt % ethylene. (2) Random copolymer of propylene and ethylene having 3 wt % ethylene. (3) Blend of 80 wt % random copolymer of propylene and ethylene having 3 wt % ethylene as in Sample II-2 and 20 wt % of an as-polymerized propylene homopolymer having an MFR of 400 g/10 minutes which is commercially available from Basell USA Inc. (4) Blend of 90 wt % random copolymer of propylene and ethylene having 3 wt % ethylene as in Sample II-2 and 10 wt % of an as-polymerized propylene homopolymer having an MFR of 400 g/10 minutes which is commercially available from Basell USA Inc. (5) Blend of 63 wt % random copolymer of propylene and ethylene having 3 wt % ethylene and a MFR of 10 g/10 minutes which is commercially available from Basell USA Inc. and 37 wt % of an as-polymerized homopolymer having a MFR of 400 g/10 minutes.		

Table 3

Sample Characteristics		
Sample No.	Max Spin Speed m/min.	P.I.
II-1	4950	2.24
II-2	4580	3.39
II-3	5780	3.31
II-4	4340	3.53
II-5	4420	3.46
II-6	3420	3.89

Table 4

Comparison of Maximum Elongation and Corresponding Tensile				
Sample No.	CD Peak tensile % Elongation	MD Peak tensile % Elongation	CD Tensile strength kg/cm	MD Tensile strength kg/cm
(1) For	Fiber Size	16.5	Microns	
II-1	60	60	1.7	3
II-2	85	90	1.3	2.2
II-3	85	90	1.7	2.3
II-4	120	90	2.3	2.5
II-5	100	90	1.7	2.5
II-6	105	90	1.9	2.7

(continued)

Comparison of Maximum Elongation and Corresponding Tensile				
Sample No.	CD Peak tensile % Elongation	MD Peak tensile % Elongation	CD Tensile strength kg/cm	MD Tensile strength kg/cm
(2) For	Fiber Size	19 microns		
II-1	60	60	1.4	2.5
II-2	100	75	1.4	1.8
II-3	110	90	1.4	1.8
II-4	90	90	1.8	1.8
II-5	85	85	1.4	2
II-6	110	90	1.6	2.3

[0064] The following observations can be drawn from this data:

1. Sample II-4 [a polyolefin composition comprising 20% by weight propylene homopolymer having an as polymerized MFR of 400 g/10 min. and 80% by weight of a random propylene/ethylene copolymer (3% ethylene) having an as polymerized MFR of 38 g/10 min.] produced a nonwoven fabric having the highest fabric elongation among the samples tested.

2. Sample II-6 [a polyolefin composition comprising 37% by weight propylene homopolymer having an as polymerized MFR of 400 g/10 min. and 63% by weight of a random propylene/ethylene copolymer (3% ethylene) having an as polymerized MFR of 10 g/10 min.] produced a nonwoven fabric having peak elongation comparable to Sample II-4. However, sample II-6 was more difficult to spin at a 16.5 micron fiber diameter than sample II-4.

Claims

1. A polyolefin composition comprising:

- A. 45 to 5 weight percent of a low viscosity propylene homopolymer having an as polymerized melt flow rate of from 250 to 550 g/10 minutes, as measured by ASTM D-1238, Condition L (230°C, 2.16 kg); and
- B. 55 to 95 weight percent of a random copolymer of propylene and ethylene and/or a C₄₋₁₀ alpha-olefin, with the copolymer containing from 90 to 99 weight percent propylene;

2. The polyolefin composition of claim 1, wherein said composition contains from 40 to 5 weight percent of component A and from 60 to 95 weight percent of component B.

3. The polyolefin composition of claim 1, wherein B has a melt flow rate of at least 10 g/10 minutes, as measured by ASTM D-1238, Condition L (230°C, 2.16 kg).

4. The polyolefin composition of claim 1, wherein said, low viscosity propylene homopolymer has a melt flow rate of from 350 to 450 g/10 minutes, as measured by ASTM D-1238, Condition L (230°C, 2.16 kg).

5. The polyolefin composition of claim 1, wherein the composition has a melt flow rate of 20 to 70 g/10 minutes, as measured by ASTM D-1238, Condition L (230°C, 2.16 kg).

6. The polyolefin composition of claim 1, wherein a polydispersity index of said composition is from 3.0 to 4.5.

7. A fiber prepared from the composition of claim 1, and having a fiber diameter of from 15 to 23 μm .

8. The fiber of claim 7, wherein said fiber diameter ranges from 16 to 20 μm .

9. A non-woven fabric comprising the fiber of claim 7 and having a peak tensile elongation of at least 80%, as measured

by ASTM D-5035 at a fabric weight of from 21 to 26 g/m.

10. The non-woven fabric of claim 9, wherein said peak tensile elongation is at least 100%, as measured by ASTM D-5035 at a fabric weight of from 21 to 26 g/m.

11. The non-woven fabric of claim 10, wherein said peak tensile elongation is at least 120%, as measured by ASTM D-5035 at a fabric weight of from 21 to 26 g/m.

12. The non-woven fabric of claim 9, wherein the tensile strength of said fabric is less than 750 g/cm, as measured by ASTM D-5035.

13. The non-woven fabric of claim 9, wherein said tensile strength is less than 700 g/cm, as measured by ASTM D-5035.

Patentansprüche

1. Polyolefin-Zusammensetzung, die Folgendes umfasst:

A. 45 bis 5 Gew.-% eines niedrigviskosen Propylen-Homopolymers mit einer wie polymerisierten Schmelzflussrate, wie nach ASTM D-1238, Bedingung L (230 °C, 2,16 kg) gemessen, von 250 bis 550 g/10 Minuten; und
B. 55 bis 95 Gew.-% eines statistischen Copolymers von Propylen und Ethylen und/oder einem C₄- bis C₁₀- α -Olefin, wobei das Copolymer von 90 bis 99 Gew.-% Propylen enthält.

2. Polyolefin-Zusammensetzung nach Anspruch 1, worin die Zusammensetzung von 40 bis 5 Gew.-% Komponente A und von 60 bis 95 Gew.-% Komponente B enthält.

3. Polyolefin-Zusammensetzung nach Anspruch 1, worin B eine Schmelzflussrate, wie nach ASTM D-1238, Bedingung L (230 °C, 2,16 kg) gemessen, von mindestens 10 g/10 Minuten aufweist.

4. Polyolefin-Zusammensetzung nach Anspruch 1, worin das niedrigviskose Propylen-Homopolymer eine Schmelzflussrate, wie nach ASTM D-1238, Bedingung L (230 °C, 2,16 kg) gemessen, von 350 bis 450 g/10 Minuten aufweist.

5. Polyolefin-Zusammensetzung nach Anspruch 1, worin die Zusammensetzung eine Schmelzflussrate, wie nach ASTM D-1238, Bedingung L (230 °C, 2,16 kg) gemessen, von 20 bis 70 g/10 Minute aufweist.

6. Polyolefin-Zusammensetzung nach Anspruch 1, worin ein Polydispersitätsindex der Zusammensetzung von 3,0 bis 4,5 beträgt.

7. Faser, die aus der Zusammensetzung nach Anspruch 1 hergestellt ist, und einen Faserdurchmesser von 15 bis 23 μ m aufweist.

8. Faser nach Anspruch 7, worin der Faserdurchmesser im Bereich von 16 bis 20 μ m liegt.

9. Nicht gewebtes Flächengebilde, das die Faser nach Anspruch 7 umfasst und eine Höchstzugdehnung, wie nach ASTM D-5035 bei einem Gewicht des Flächengebildes von 21 bis 26 g/m gemessen, von mindestens 80 % aufweist.

10. Nicht gewebtes Flächengebilde nach Anspruch 9, worin die Höchstzugdehnung, wie nach ASTM D-5035 bei einem Gewicht des Flächengebildes von 21 bis 26 g/m gemessen, mindestens 100 % beträgt.

11. Nicht gewebtes Flächengebilde nach Anspruch 10, worin die Höchstzugdehnung, wie nach ASTM D-5035 bei einem Gewicht des Flächengebildes von 21 bis 26 g/m gemessen, mindestens 120 % beträgt.

12. Nicht gewebtes Flächengebilde nach Anspruch 9, worin die Zugfestigkeit des Flächengebildes, wie nach ASTM D-5035 gemessen, weniger als 750 g/cm beträgt.

13. Nicht gewebtes Flächengebilde nach Anspruch 9, worin die Zugfestigkeit, wie nach ASTM D-5035 gemessen, weniger als 700 g/cm beträgt.

Revendications

1. Composition polyoléfinique comprenant :

- A. 45 à 5% en poids d'un homopolymère de propylène de basse viscosité présentant un indice de fluidité polymérisé de 250 à 550 g/10 minutes, tel que mesuré par la norme ASTM D-1238, condition L (230°C, 2,16 kg) : et
B. 55 à 95% en poids d'un copolymère statistique de propylène et d'éthylène et/ou d'une alpha-oléfine en C₄₋₁₀, le copolymère contenant 90 à 99 pour cent en poids de propylène ;

2. Composition polyoléfinique selon la revendication 1, où ladite composition contient 40 à 5% en poids du composant A et 60 à 95% en poids du composant B.

3. Composition polyoléfinique selon la revendication 1, dans laquelle B présente un indice de fluidité d'au moins 10 g/10 minutes, tel que mesuré par la norme ASTM D-1238, condition L (230°C, 2,16 kg).

4. Composition polyoléfinique selon la revendication 1, dans laquelle ledit homopolymère de propylène de basse viscosité présente un indice de fluidité de 350 à 450 g/10 minutes, tel que mesuré par la norme ASTM D-1238, condition L (230°C, 2,16 kg).

5. Composition polyoléfinique selon la revendication 1, où la composition présente un indice de fluidité de 20 à 70 g/10 minutes, tel que mesuré par la norme ASTM D-1238, condition L (230°C, 2,16 kg).

6. Composition polyoléfinique selon la revendication 1, où l'indice de polydispersité de ladite composition est de 3,0 à 4,5.

7. Fibre préparée à partir de la composition de la revendication 1 et présentant un diamètre de fibre de 15 à 23 µm.

8. Fibre selon la revendication 7, où ledit diamètre de fibre s'étend de 16 à 20 µm

9. Tissu non tissé comprenant la fibre selon la revendication 7 et présentant une elongation au pic de traction d'au moins 80%, telle que mesurée par la norme ASTM D-5035 à un poids de tissu de 21 à 26 g/m.

10. Tissu non tissé selon la revendication 9, dans lequel ladite elongation au pic de traction est d'au moins 100%, telle que mesurée par la norme ASTM D-5035 à un poids de tissu de 21 à 26 g/m.

11. Tissu non tissé selon la revendication 10, dans lequel ladite elongation au pic de traction est d'au moins 120%, telle que mesurée par la norme ASTM D-5035 à un poids de tissu de 21 à 26 g/m.

12. Tissu non tissé selon la revendication 9, où la résistance à la traction dudit tissu est inférieure à 750 g/cm, telle que mesurée par la norme ASTM D-5035.

13. Tissu non tissé selon la revendication 9, dans lequel ladite résistance à la traction est inférieure à 700 g/cm, telle que mesurée par la norme ASTM D-5035.

REFERENCES CITED IN THE DESCRIPTION

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